

ADPA/NSIA Aircraft Survivability Symposium

***Vulnerability Reduction:
Critical For Today and Tomorrow***



presented by
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Hughes Aircraft Company

VULNERABILITY REDUCTION CRITICAL FOR TODAY AND TOMORROW

THANK YOU FOR THE KIND INTRODUCTION, MR. VICE, ADMIRAL EVANS, GENERAL BURKE, ADMIRAL GORMLEY, MR. FRANCIS, MR. MUTZELBURG, DISTINGUISHED GUESTS, MEN AND WOMEN OF THE SURVIVABILITY COMMUNITY, LADIES AND GENTLEMEN ---- I CAN NOT TELL YOU HOW HONORED I AM TO HAVE BEEN INVITED TO SPEAK TO THIS SYMPOSIUM.

I CONGRATULATE YOU ON YOUR CHOICE OF LOCATIONS TO HOLD THIS SYMPOSIUM. NAVY POSTGRADUATE SCHOOL, MONTEREY, CA ----THE PLACE WHERE SO MANY OF US HAVE GAINED AN APPRECIATION AND UNDERSTANDING OF SURVIVABILITY FROM PROFESSOR ROBERT BALL, AND THE BIRTHPLACE OF THE BIBLE FOR THIS DISCIPLINE— HIS TEXT BOOK THE FUNDAMENTALS OF AIRCRAFT COMBAT SURVIVABILITY ANALYSIS AND DESIGN.

YOU HAVE COME A LONG WAY, AND THE SUCCESSES OF YOUR PRODUCTS IN DESERT STORM HAVE PROVEN THE VALUE OF THE EXPERTISE THAT YOU HAVE PROVIDED TO THE AIRCRAFT DESIGN COMMUNITY.

THE DEFENSE BUDGET HAS DECLINED 40% IN THE PAST EIGHT YEARS, BUT THE PROCUREMENT BUDGET HAS DECLINED OVER SIXTY PERCENT. WE ARE BUYING REPLACEMENT HARDWARE, AIRCRAFT, SHIPS, TANKS, TRUCKS AT A RATE THAT WILL NOT COME CLOSE TO SUSTAINING THE SIZE OF THE FORCE STRUCTURE THAT STUDY AFTER STUDY SHOWS OUR NATION NEEDS. YOU ALL KNOW TOO WELL THIS IS A TIME OF CHANGE UNLIKE ANY OTHER.

I'M REMINDED OF THE STORY OF THE TRUCK DRIVER GOING DOWN A STEEP WINDY MOUNTAINSIDE ROAD-----

LET GO; TRUST ME. IS THERE ANYONE ELSE UP THERE WHO CAN HELP ME?

LIKE MY LITTLE STORY, THE ENVIRONMENT TODAY IS SAYING TRUST ME, LET GO ----- YCJ CANNOT GO ON DOING THINGS THE SAME WAY. IN MY BRIEF REMARKS THIS MORNING I HOPE TO LEAVE YOU WITH SIX CHALLENGES:

1. THE SURVIVABILITY WORLD NEEDS IMPROVED MODELING AND SIMULATION, AND YOU NEED TO APPLY IT EARLIER AND MORE OFTEN IN THE DESIGN PROCESS.

2. GREATER UNDERSTANDING NEEDS TO BE ACHIEVED OF YOUR DISCIPLINE THROUGHOUT THE DOD COMMUNITY.
3. THE SURVIVABILITY COMMUNITY NEEDS TO BE BETTER INTEGRATED WITH THE EW, RELIABILITY AND SYSTEMS SAFETY COMMUNITIES.
4. A SYSTEMS OF SYSTEMS PERSPECTIVE NEEDS TO BE INTEGRATED INTO SURVIVABILITY ANALYSIS
5. A HIGH LEVEL DOD CHAMPION IS NEEDED TO SUPPORT THE INITIATIVES OF THE SURVIVABILITY COMMUNITY.

BUT, TO MAKE THE CHANGES AND IMPROVEMENTS I HAVE LISTED
"YOU CAN'T JUST KEEP DOING WHAT YOU'VE ALWAYS BEEN
DOING. OR YOU'LL GET WHAT YOU'VE ALWAYS GOTTEN

LET ME SHOW YOU A COUPLE OF VIEWGRAPHS THAT MAKE THE
POINT OF HOW WE ARE NOT BUYING AIRCRAFT AT A RATE
SUFFICIENT TO SUSTAIN THE FORCE STRUCTURE.

THESE NAVY CHART SHOWS THAT THE NUMBER OF AIRCRAFT IN THE INVENTORY HAS DECLINED, BUT IS PLANNED TO REMAIN RELATIVELY STEADY. THE NEXT CHART DRAMATICALLY SHOWS THE DECLINE IN NUMBER OF AIRCRAFT BOUGHT PER YEAR.

THE NEXT CHART SHOWS HOW LONG TACTICAL AIRCRAFT ARE REMAINING IN THE INVENTORY. THE MESSAGE IS LOUD AND CLEAR--- WE ARE NOT PROCURING AIRCRAFT AT A HIGH ENOUGH RATE.

THIS HAS SIGNIFICANT IMPLICATIONS FOR THE WORLD OF SURVIVABILITY, AND MOST DEFINITELY VULNERABILITY REDUCTION. WE ARE DEPENDING ON USING OUR AIRCRAFT FOR LONGER PERIODS OF TIME, IN PEACE TIME AND IN WAR. AND WE EXPECT THEM TO SURVIVE WHEN USED IN ANGER.

THE DEBATES RAGE OVER THE RIGHT BALANCE OF CRUISE MISSILES, STAND OFF WEAPONS, STEALTH AIRCRAFT, AND IN THE FUTURE UNINHABITED COMBAT AIR VEHICLES. BUT IN EACH OF THESE VEHICLES THE NEED FOR SUSCEPTABILITY AND VULNERABILITY REDUCTIONS LOOM HIGH, AND THE COST OF EACH OF THESE SYSTEMS DEMANDS THAT SURVIVABILITY BE AN UPFRONT DESIGN CONSIDERATION.

ACQUISITION REFORM IS MOVING VERY WELL, AND UNDER DR. GANSLER I FULLY EXPECT THE RATE OF POSITIVE CHANGE TO CONTINUE. COST AS AN INDEPENDENT VARIABLE IS THE BENCHMARK THAT MUST BE USED TO DESIGN AND DEVELOP OUR SYSTEMS FOR THE FUTURE. I REALIZE THAT THE UNDERSTANDING AND SUCCESSFUL USE OF CAIV IS SPOTTY, BUT I CAN ASSURE YOU THAT DOD'S COMMITMENT TO MAKE THIS SUCCEED IS STRONG--- AND SURVIVABILITY MUST BE PART OF THE COST BENEFIT ANALYSIS TRADES.

OTHER ACQUISITION REFORM INITIATIVES INCLUDE GOING TO PERFORMANCE SPECS, THE ABSENCE OF MIL SPECS, AND THE INCREASED USE OF COMMERCIAL CONTENT IN ALL OF OUR SYSTEMS.

IF YOU ARE NOT WORRIED ---- YOU BETTER WAKE UP. WHEN THE COST TRADES ARE MADE, AND THE COMMERCIAL CONTENT APPLIED, ARE YOU CONFIDENT THAT THE SURVIVABILITY DISCIPLINE WILL HAVE A SEAT AT THE DECISION TABLE?

WHEN THE TEST PLAN IS CREATED AND THE LIVE FIRE TEST PROGRAM DEVELOPED, WILL IT BE AFFORDABLE, OR WILL IT BREAK THE AFFORDABILITY BANK OF THE PROGRAM?

THOSE QUESTIONS SHOULD CONVINCE YOU THAT THE TIME IS NOW TO FIND MORE AFFORDABLE WAYS TO KEEP SURVIVABILITY AT THE FRONT OF THE DECISION PROCESS. IT IS FAR TOO LATE WHEN THE SYSTEM FAILS A LIVE FIRE DEMO OR A SURVIVABILITY TEST TO MAKING THE NEEDED DESIGN CHANGES.

WE NEED A BETTER APPROACH TO MODELING AND SIMULATION.

THE JTCG (AS) HAS BEEN VALIANTLY WORKING FOR THE PAST 10 YEARS, IN WHICH I'VE BEEN SOMEWHAT INVOLVED, IN THE VV&A OF A STANDARD SET OF SURVIVABILITY MODELS. THE GOOD NEWS IS THAT THE OSD FUNDING FOR THIS VITAL EFFORT APPEARS TO BE GETTING SUPPORT, ALBEIT ONLY AT THE RELATIVELY LOW LEVEL OF ABOUT \$ 7 MILLION A YEAR.

SIX YEARS AGO I BECAME INVOLVED IN TRYING TO FIND A WAY TO CREATE A PANEL OF OUR NATION'S FOREMOST SURVIVABILITY EXPERTS TO REVIEW EVERY MAJOR PROGRAM'S PROPOSED M&S PLAN FOR SURVIVABILITY ANALYSIS. THE EXPECTATION WAS THAT A CONSISTENT SET OF MODELS WOULD BE UTILIZED, LESSONS LEARNED WOULD BE SHARED FROM PROGRAM TO PROGRAM, THE FIDELITY AND UTILITY OF MODELS WOULD IMPROVE, THE DOLLARS SPENT ON M&S IN BOTH INDUSTRY AND THE GOVERNMENT WOULD BE MORE FOCUSED AND THEREBY MORE EFFICIENTLY USED, AND LASTLY, AND MOST IMPORTANTLY, WE

WOULD AVOID THE COSTLY LATE IN THE GAME DISPUTES OVER THE SELECTION OF THE MODELS USED OR THE VALIDITY OF THE RESULTS ACHIEVED.

WHEN I WAS ASKED TO SPEAK AT THIS SYMPOSIUM, I INQUIRED AS TO THE STATUS OF THE EFFORT TO CHARTER A BODY OF "EXPERTS IN SURVIVABILITY" TO VALIDATE THE M&S PLANS FOR THE SURVIVABILITY ANALYSIS OF AIRCRAFT SYSTEMS. I WAS TOLD THAT IT IS BASICALLY JUST WHERE IT WAS WHEN I LEFT DOD, OR WHEN I DEPARTED THE JACG IN MAR OF 95.

CHANGE IS OFTEN DIFFICULT TO BRING ABOUT, BUT I HAVE NEVER SEEN ANYTHING THAT SEEMED SO LOGICAL TO DO, BE SO DIFFICULT TO BRING ABOUT.

UNLESS THIS COMMUNITY FINDS A WAY TO GAIN SERVICE AND OSD ACCEPTANCE, AND YES APPROVAL, OF THE M&S PLANS DEVELOPED FOR SYSTEMS BEFORE THE EFFORTS ARE EXPENDED RUNNING THE SCENARIOS AND COMPLETING THE ANALYSIS, WE WILL CONTINUE TO INVITE COSTLY DISPUTES, THAT DELAY PROGRAMS, ARGUING OVER THE SELECTION OF MODELS AND SCENARIOS IN ASSESSING A SYSTEM'S SURVIVABILITY.

I'M REMINDED OF THE STORY OF THE THREE DOD COMPTROLLERS WHO DIED, AND TO ST. PETER'S AMAZEMENT WENT TO HEAVEN AND WERE STANDING OUTSIDE THE PEARLY GATES. -----

"THEY'RE GONE" ALL THREE ARE GONE? "NO, THEY HAVE TAKEN THE PEARLY GATES"

THERE'S A MESSAGE IN THAT STORY, BECAUSE THE COMPTROLLERS HAVE NO CHOICE BUT TO SPREAD THE LIMITED DEFENSE DOLLARS TO COVER ALL NEEDS. AND THAT MEANS NOT HAVING ENOUGH IN MOST PROGRAMS TO DO ALL THAT IS NEEDED TO BE DONE.

AND THIS GETS ME TO MY **SECOND POINT. SURVIVABILITY IS A DISCIPLINE THAT IS NOT WELL UNDERSTOOD.** YES, PEOPLE UNDERSTAND RADAR SIGNATURE AND THE ADVANTAGES OF STEALTH, AND THE NEEDS FOR ELECTRONIC COUNTERMEASURES. BUT VERY FEW PEOPLE APPRECIATE, NOR DO THE REQUIREMENT SETTERS EVEN SET REQUIREMENTS FOR VULNERABILITY.

THE LIVE FIRE TEST LAW WAS NEEDED WHEN IT WAS ENACTED. INADEQUATE ATTENTION WAS BEING PAID TO VULNERABILITY IN THE DESIGN OF OUR SYSTEMS. BUT I DO BELIEVE THAT DOD HAS RECEIVED THE MESSAGE, AND VULNERABILITY IS A STRONG DESIGN CONSIDERATION IN ALL OF OUR NEW SYSTEMS.

BUT IT IS TIME FOR A MAJOR REASSESSMENT OF HOW THE LIVE FIRE TEST LAW IS BEING APPLIED. WE SIMPLY CANNOT AFFORD TO DO FULL SCALE LIVE FIRE TESTS ON ALL PLATFORMS. THERE ARE EXAMPLES OF SUCCESSFUL APPLICATION OF THE LAW, SUCH AS THE V-22. WHERE SELECTED MAJOR COMPONENT TESTS ARE BEING CONDUCTED, AND AN ENTIRE VEHICLE WILL NOT BE USED FOR THE LIVE FIRE TEST.

HOWEVER, THE V-22 IS NOT THE GENERAL RULE. WE NEED A BETTER SET OF MODELS FOR VULNERABILITY ANALYSIS. ONE CAN NEVER USE M&S FOR THE ENTIRE VULNERABILITY ANALYSIS, BUT SMART M&S CAN BE USED IN CONJUNCTION WITH COMPONENT AND COUPON TESTS TO GREATLY REDUCE THE COST OF A LIVE FIRE TEST PROGRAM, WITH LITTLE RISK IN NOT CORRECTLY UNDERSTANDING THE VULNERABILITY OF THE SYSTEM.

BUT TO BRING ABOUT ANY CHANGE, YOU NEED TO HAVE UNDERSTANDING AMONG THE DECISION MAKERS, OR THEY WILL BE UNWILLING TO GO FORWARD ASKING TO CHANGE A LAW OR SEEK A WAIVER. SO I REITERATE THE POINT ON THE NEED TO GET INCREASED UNDERSTANDING, ESPECIALLY OF THE VULNERABILITY PART OF SURVIVABILITY, AMONG THE DECISION MAKERS IN DOD.

THE THIRD POINT:

INTEGRATION OF SURVIVABILITY WITH THE EW COMMUNITY

IS A MUST. WE HAVE BEEN TALKING ABOUT THIS FOR YEARS, BUT THE NEED IS GREATER NOW THAN EVER BEFORE.

SIGNATURE REDUCTION HAS TAKEN ENORMOUS STRIDES AND HAS BEEN A BIG BOOST FOR SURVIVABILITY. BUT THIS HAS HIGHLIGHTED THE NEED TO LOOK AT THE TOTAL AIRCRAFT SOLUTION TO SURVIVAL.

THIS CHART SHOWS WHAT I CALL THE SURVIVABILITY ANALYSIS FUNNEL. FROM MISSION PLANNING, SUPPORT ASSETS, THE INHERENT SIGNATURE OF THE VEHICLE, THE SMART USE OF RWR AND FLYING THE ROUTE, THE APPLICATION OF ECM, TOWED DEVICES AND EXPENDABLES, AND THEN IF HIT, THE VULNERABILITY OF THE PLATFORM.

YOU HAVE ALL SEEN VERSIONS OF THIS BEFORE. BUT IT THIS COMMUNITY'S RESPONSIBILITY TO HELP THE DECISION MAKER AND THE SYSTEM DESIGNER IN MAKING THE RIGHT TRADES.

IN FACT IT REQUIRES MORE THAN JUST INTEGRATING THE EW AND SURVIVABILITY COMMUNITIES. THE RELIABILITY COMMUNITY AS WELL AS THE SYSTEM SAFETY COMMUNITY MUST BE INTEGRATED INTO YOUR DESIGN PROCESS. I TRUST THAT THE INCREASED USE OF IPTS THROUGHOUT THE INDUSTRY IS MAKING THIS EASIER THAN EVER BEFORE.

THE DESIGN DECISIONS MADE TO IMPROVE RELIABILITY VERY OFTEN SIGNIFICANTLY IMPROVE SURVIVABILITY. TAKE THE RECONFIGURABLE CENTRAL PROCESSOR THAT MY COMPANY HUGHES HAS DESIGNED FOR THE F-22.

OR THE DIGITAL FLIGHT CONTROL SYSTEM AND ITS RECONFIGURABLE CAPABILITIES THAT ARE RESIDENT ON THE F/A-18 TODAY AND WERE SUCCESSFULLY DEMONSTRATED DURING DESERT STORM.

THE ROBUST ELECTRONIC DESIGNS WE ARE LOOKING AT FOR FUTURE SYSTEMS HAVE GRACEFUL DEGRADATION BUILT IN. FROM A VULNERABILITY STAND POINT THAT MEANS BEING ABLE TO SUSTAIN DAMAGE BUT CONTINUE TO OPERATE IN ORDER TO SUCCESSFULLY COMPLETE THE MISSION.

SYSTEM REDUNDANCY, GRACEFUL DEGRADATION ARE BEING DRIVEN BY THE NEED TO IMPROVE RELIABILITY AND DECREASE LIFE CYCLE COST. TO DO THIS SMART REQUIRES CLOSE INTEGRATION OF THE SURVIVABILITY, RELIABILITY, SYSTEMS SAFETY, FLIGHT CONTROL, PROPULSION, FUELS, AND EW COMMUNITIES.

UP UNTIL THIS POINT WE HAVE SPOKEN ABOUT THE SURVIVABILITY AND VULNERABILITY ENHANCEMENT OF A SINGLE PLATFORM. WE NEED TO **EXTEND OUR VIEW BEYOND THE INDIVIDUAL PLATFORM AND LOOK AT SURVIVABILITY FROM A SYSTEMS OF SYSTEMS PERSPECTIVE.**

WE DO NOT NEED THE FULL CAPABILITY, INCLUDING THE ABSOLUTE END ALL SURVIVABILITY, IN EVERY PLATFORM. OUR NATION SIMPLY CANNOT AFFORD THE PRICE, UNLESS WE WANT AN AVIATION CAPABILITY WITH VERY FEW AIRCRAFT.

TODAY A SIGNIFICANT EFFORT IS CORRECTLY BEING APPLIED INTO MAKING OUR WEAPONS SURVIVABLE. THE SAME DESIGN PROCESS THAT IS USED FOR MANNED PLATFORMS APPLIES.

COST TRADES NEED TO BE MADE, AND THIS COMMUNITY HAS THE TOOLS THAT NEED TO BE INCORPORATED INTO THE SYSTEMS OF SYSTEMS LOOKS THAT SHOULD BE USED IN CONJUNCTION WITH COST AS AN INDEPENDENT VARIABLE FOR EACH SYSTEM WE PROCURE.

LIVING WITHIN THE PREDICTED BUDGETS OF THE FUTURE, AND SUSTAINING A FORCE STRUCTURE OF THE SIZE OUR NATION CONTINUES TO REAFFIRM ITS NEED FOR, REQUIRES THAT THE SYSTEM OF SYSTEM PERSPECTIVE BE APPLIED TO DETERMINE THE CAPABILITIES NEEDED IN EACH OF OUR WEAPON SYSTEMS.

THE LAST POINT I'D LIKE TO LEAVE YOU WITH IS THE ABSOLUTE **NEED TO FIND A TRUE CHAMPION, AT A VERY SENIOR LEVEL, FOR SURVIVABILITY IN DOD.**

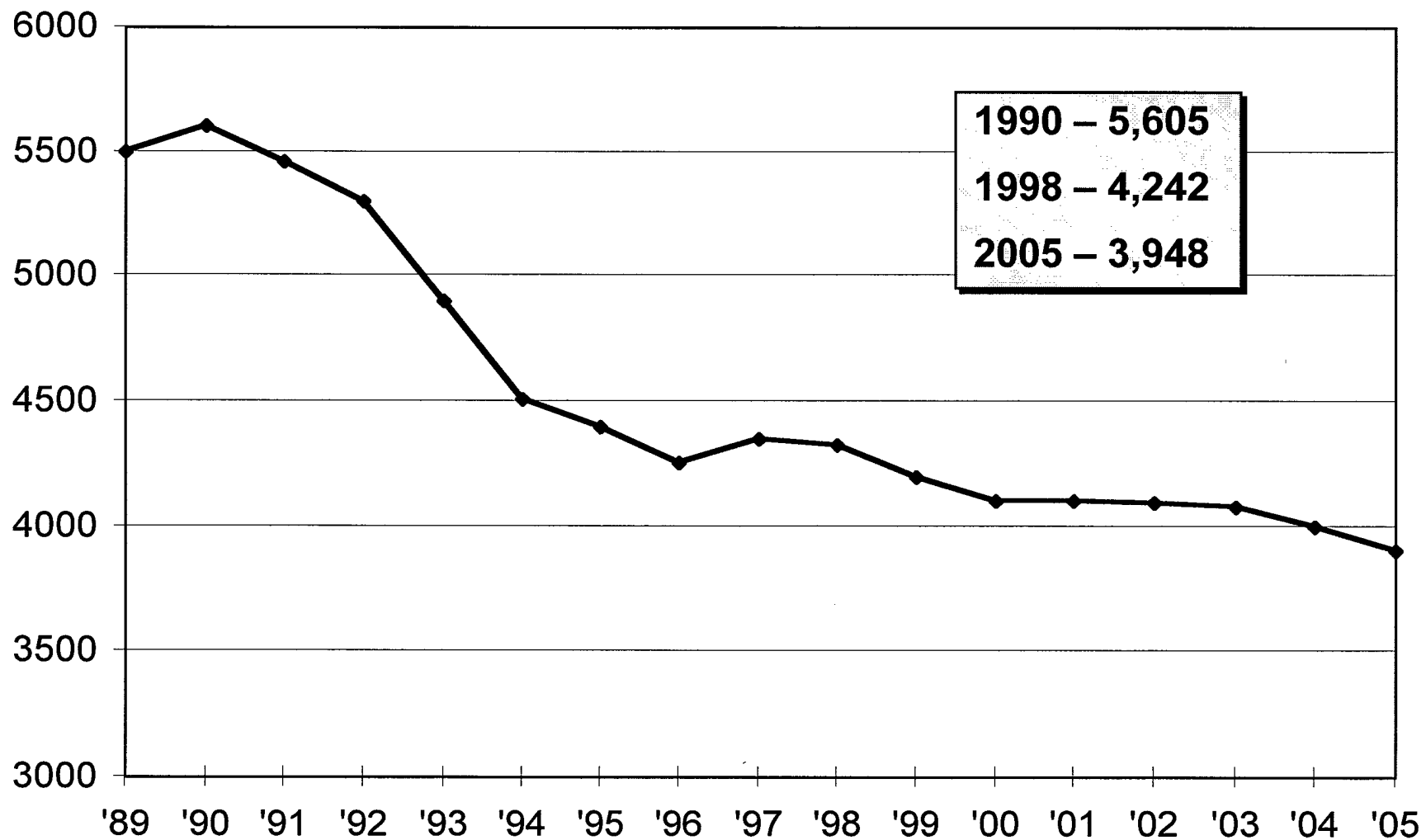
THE CHANGES THAT DOD IS UNDERGOING DEMAND THAT THE VERY IMPORTANT DISCIPLINE OF SURVIVABILITY HAVE A SPOKESPERSON WHO HAS THE UNDERSTANDING AND WILL MAKE THE COMMITMENT TO SUPPORT THE SMART THINGS THAT NEED TO BE DONE TO KEEP SURVIVABILITY AT THE HEAD TABLE AS AN AFFORDABLE AND VITAL DISCIPLINE FOR THE DESIGN OF ALL OF OUR AIR SYSTEMS.

IN CONCLUSION, I TALKED ABOUT SIX CHALLENGES AND NEEDS.
OR ACTIONS THAT NEED TO BE TAKEN:

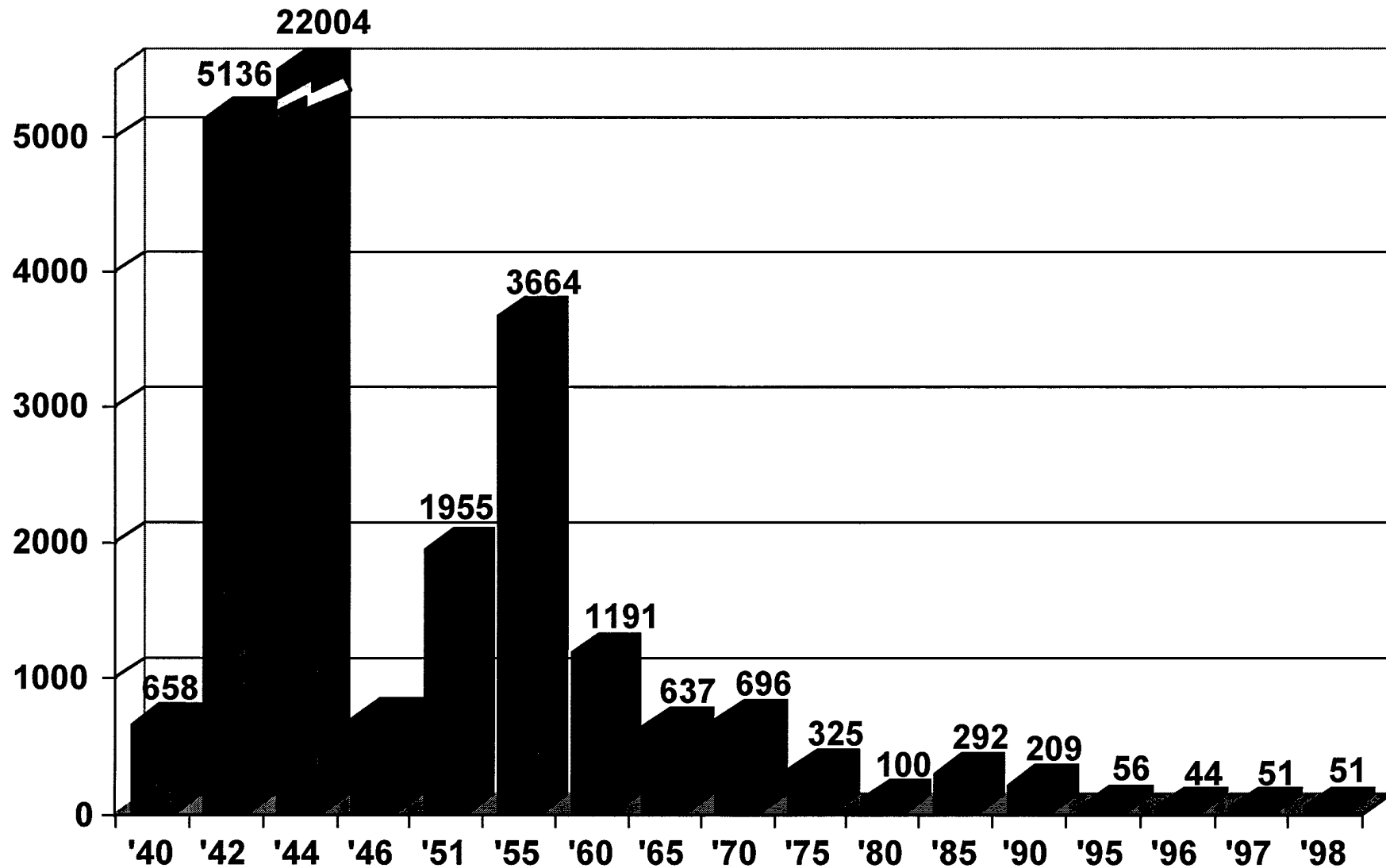
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APPROACH FOR M&S FOR SURVIVABILITY
2. YOU NEED TO GET MUCH GREATER UNDERSTANDING OF
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THE ACQUISITION PROCESS—IN BOTH GOVERNMENT
AND INDUSTRY
3. YOU NEED TO INTEGRATE THE EW COMMUNITY WITH
SURVIVABILITY, AS WELL AS RELIABILITY AND SYSTEMS
SAFETY.
4. YOU NEED TO ADD A SYSTEMS OF SYSTEMS PERSPECTIVE
TO SURVIVABILITY ANALYSIS
5. AND LASTLY, YOU NEED A HIGH LEVEL SURVIVABILITY
CHAMPION WITHIN THE DOD.

THANK YOU FOR YOUR ATTENTION AND FOR GIVING ME THE
OPPORTUNITY TO TALK TO YOU THIS MORNING. I'D BE PLEASED TO
ANSWER ANY QUESTIONS.

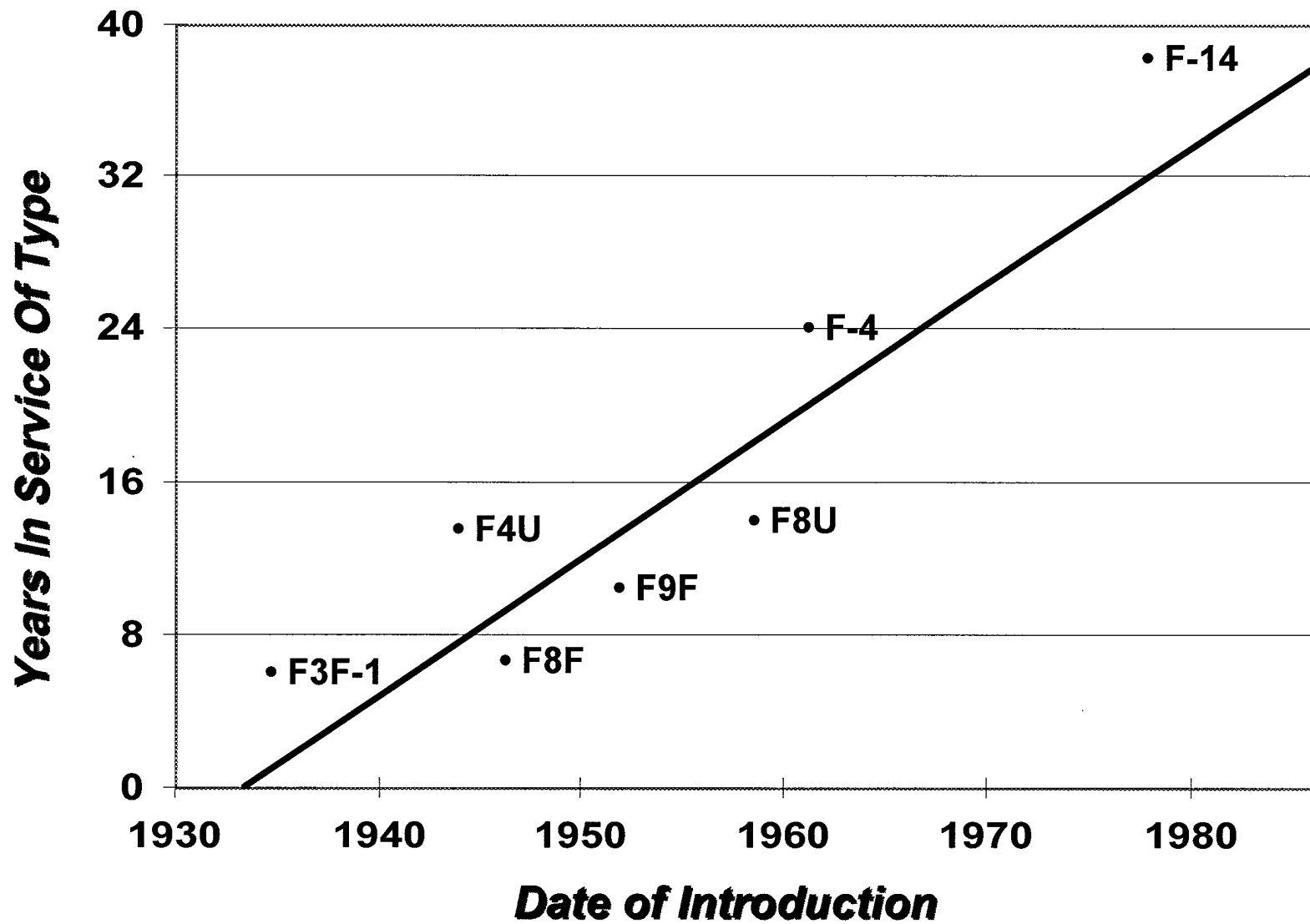
Navy/Marine Corps Aircraft Inventory



Number of Navy Aircraft Accepted Per Year



Fighters Decade of Introduction



Survivability Challenges & Needs



- 1. Improved and affordable M&S**
- 2. Greater understanding of survivability discipline**
- 3. Integration with EW and Reliability communities**
- 4. System of Systems perspective**
- 5. A high level Survivability Champion**

The Survivability Assessment Funnel

HUGHES
AIRCRAFT

